CLAIMS

Having thus described the invention, what is claimed is the following:

1   1.   An image processing system suited for post-processing compressed and
2   decompressed images, the system comprising:
3   a region segmenter configured to sub-divide data representing at least one
4   image frame to generate a plurality of image regions;
5   an artifact detector configured to analyze each of the plurality of image regions
6   for the existence of an image artifact, the artifact detector further configured to
7   identify regions containing an image artifact;
8   a filter configured to receive an indication of image regions containing an
9   image artifact from the artifact detector, wherein the filter smoothes at least one
10   picture element data value in accordance with at least one viewer selected parameter
11   to generate modified picture element data; and
12   an output memory communicatively coupled with the filter wherein the output
13   memory assembles an image artifact reduced image frame comprising unmodified
14   picture element data from the at least one image frame and smoothed picture element
15   data to generate an artifact reduced representation of the at least one image frame.
1

1   2.   The system of claim 1, wherein the region segmenter sub-divides the at
2   least one image frame in response to a viewer selected region sensitivity value.
1

1   3.   The system of claim 1, wherein the artifact detector applies at least one
2   statistical test to the picture element data values comprising the region to identify
3   when the region contains an image artifact.
1

1   4.   The system of claim 1, wherein the filter selectively smoothes picture
2   element data values comprising the region in response to a block sensitivity parameter
3   and a picture element data value comparison threshold.
1

1   5.   The system of claim 1, wherein the filter comprises an edge-preserving

2 low-pass filter.

1

1   6.   The system of claim 1, further comprising:

2   a communications port configured to receive the at least one viewer selected

3 imaging parameter; and

4   a controller communicatively coupled with the communications port wherein

5 the controller is configured to control the flow of picture elements in response to the

6 at least one viewer selected imaging parameter.

1

1   7.   The system of claim 1, further comprising:

2   a delay module configured to receive a decompressed audio signal, wherein

3 the delay module synchronizes the image artifact reduced image frame with the

4 decompressed audio signal.

1

1   8.   The system of claim 2, wherein the viewer selected region sensitivity

2 value defines a plurality of picture elements equivalent to the square of the region

3 sensitivity value.

1

1   9.   The system of claim 3, wherein the at least one statistical test

2 comprises a mean picture element data value.

1

1   10.   The system of claim 4, wherein the filter smoothes picture element data

2 values when both the absolute value of the difference between picture element data

3 values for adjacent picture elements exceeds the picture element data value

4 comparison threshold and wherein the compared picture elements form a block

5 boundary as defined by the square of a block sensitivity value.

1

1   11.   The system of claim 4, wherein the block sensitivity parameter and the

2 picture element data value comparison threshold are viewer selected.

1

1   12.   The system of claim 9, wherein an absolute value of the difference

2   between the mean picture element data value and a maximum picture element data

3   value for the region provides a first interim result, and wherein an absolute value of

4   the first interim result is compared with an image artifact detection threshold.

1

1   13.   The system of claim 9, wherein an absolute value of the difference

2   between the mean picture element data value and a minimum picture element data

3   value for the region provides a second interim result, and wherein an absolute value of

4   the second interim result is compared with an image artifact detection threshold.

1

1   14.   An image processing system suited for post-processing compressed and

2   decompressed images, the system comprising:

3   means for analyzing data associated with a plurality of picture elements

4   comprising at least one image frame to identify portions of the at least one image

5   frame that contain image artifacts;

6   means for smoothing at least one data value associated with the plurality of

7   picture elements in the identified sub-portion of the at least one image frame; and

8   means for assembling an image artifact reduced image comprising smoothed

9   picture elements.

1

1   15.   The system of claim 14, wherein the means for analyzing comprises

2   performing at least one statistical test on the picture element data values on a sub-

3   portion of the at least one image frame.

1

1

1

1

1

· 1

1

1

1   16.   The system of claim 14, wherein the means for smoothing comprises a

2 mathematical combination of a picture element of interest with an adjacent picture

3 element in a first direction to form a first smoothing result, followed by a

4 mathematical combination of the picture element of interest with an adjacent picture

5 element in a second direction using the first smoothing result for the picture element

6 of interest data value for those cases where the picture element of interest is adjacent

7 to a block as defined by a block sensitivity value.

1

1   17.   The system of claim 14, wherein the means for assembling comprises a

2 frame memory device configured to store both unmodified picture element data and

3 modified picture element data, wherein modified picture element data supersedes

4 unmodified picture element data.

1

1   18.   The system of claim 15, wherein the at least one statistical test

2 comprises determining the mean picture element data value on a sub-portion of the at

3 least one image frame.

1

1   19.   The system of claim 16, wherein the mathematical combination of a

2 picture element of interest with an adjacent picture element comprises determining the

3 average data value of the picture element of interest and the adjacent picture element

4 and updating the data value of the picture element of interest with the determined

5 average.

1

1

1

1

1

1

1

1

1

1   20.   A method for reducing image artifacts in a compressed and

2 decompressed image, comprising:

3   receiving picture element data associated with at least one image frame;

4   segmenting the at least one image frame into a plurality of regions in

5 accordance with a first viewer selected imaging parameter;

6   analyzing the plurality of segmented regions to identify regions that contain an

7 image artifact in response to a second viewer selected imaging parameter;

8   processing the identified regions with an adaptive filter such that at least one

9 picture element data parameter is adjusted in response to both a third and a fourth

10 viewer selected imaging parameters; and

11   inserting adjusted picture element data values into the at least one image

12 frame.

1

1   21.   The method of claim 20, wherein the first viewer selected imaging

2 parameter applied in the segmenting step comprises a region sensitivity value.

1

1   22.   The method of claim 20, wherein the second viewer selected imaging

2 parameter applied in the analyzing step comprises an image artifact detection

3 threshold.

1

1   23.   The method of claim 20, wherein the third and the fourth viewer

2 selected imaging parameters applied in the processing step comprise a block

3 sensitivity value, and a picture element comparison threshold, respectively.

1

1

1

1

1

1

1

1   24.   A method for smoothing at least one data value associated with a

2 plurality of picture elements containing image artifacts introduced in a compressed

3 and decompressed image, comprising:

4   setting a plurality of counters and a plurality of thresholds in response to a

5 plurality of viewer selected imaging parameters;

6   systematically comparing each of a plurality of picture element data values

7 with a data value associated with an adjacent picture element in a first direction to

8 generate a first interim result, further comparing the first interim result with a first

9 viewer selected imaging parameter, selectively modifying the data value for a picture

10 element of interest to generate a temporary picture element data value when the

11 compared picture elements traverse a block boundary as defined by a second viewer

12 selected imaging parameter;

13   inserting temporary picture element data values; and

14   systematically comparing each of the plurality of picture element data values,

15 including the inserted temporary picture element data values with an adjacent picture

16 element in a second direction to generate a second interim result, further comparing

17 the second interim result with a first viewer selected imaging parameter, selectively

18 modifying the data value for a picture element of interest to generate a final picture

19 element data value when the compared picture elements traverse a block boundary as

20 defined by a second viewer selected imaging parameter.

1

1   25.   The method of claim 24, wherein the steps of comparing are responsive

2 to a first viewer selected imaging parameter comprising a smoothing threshold.

1

1   26.   The method of claim 24, wherein the steps of comparing are responsive

2 to a second viewer selected imaging parameter comprising a block sensitivity value.

1

1

1

i

1   27.   A method for identifying image artifacts introduced in a compressed
2 and decompressed sub-region of an image, comprising:
3   performing at least one statistical test over a plurality of picture element data
4 values comprising the sub-region to generate a test result;
5   determining an extrema element data value for the sub-region; and
6   determining when a mathematical combination of the maximum picture
7 element data value and the test result exceeds a predetermined threshold.
1

1   28.   The method of claim 27, wherein the step of determining when a
2 mathematical combination comprises determining when the absolute value of the
3 difference between the extrema picture element and the test result.
1

1

1